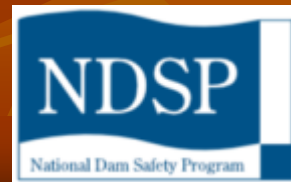




Forest Service Dam Safety Products

Presenter: Stephen Romero, P.E.
USDA Forest Service



FS Dam Safety Demographics

- 1) Full Time FS dam safety engineers 3
- 2) Number of FS owned water storage dams.....480
- 3) Number of FS regulated water storage dams..1200
- 4) Plus thousands of impoundments that don't meet the definition of a dam



Dam Owner Demographics – FS regulated

- 1) The vast majority have no engineering background
- 2) Most are ill informed about problems that indicate a structural deficiency may be present
- 3) Many owners do not have the resources to employ or retain an engineer



Despite appearances these are highly skilled engineers and contractors



Examples of FS Dams

Typical Wilderness Dam



RCC Dam



Maintenance issues on typical permitted dam



Arched reinforced concrete dams



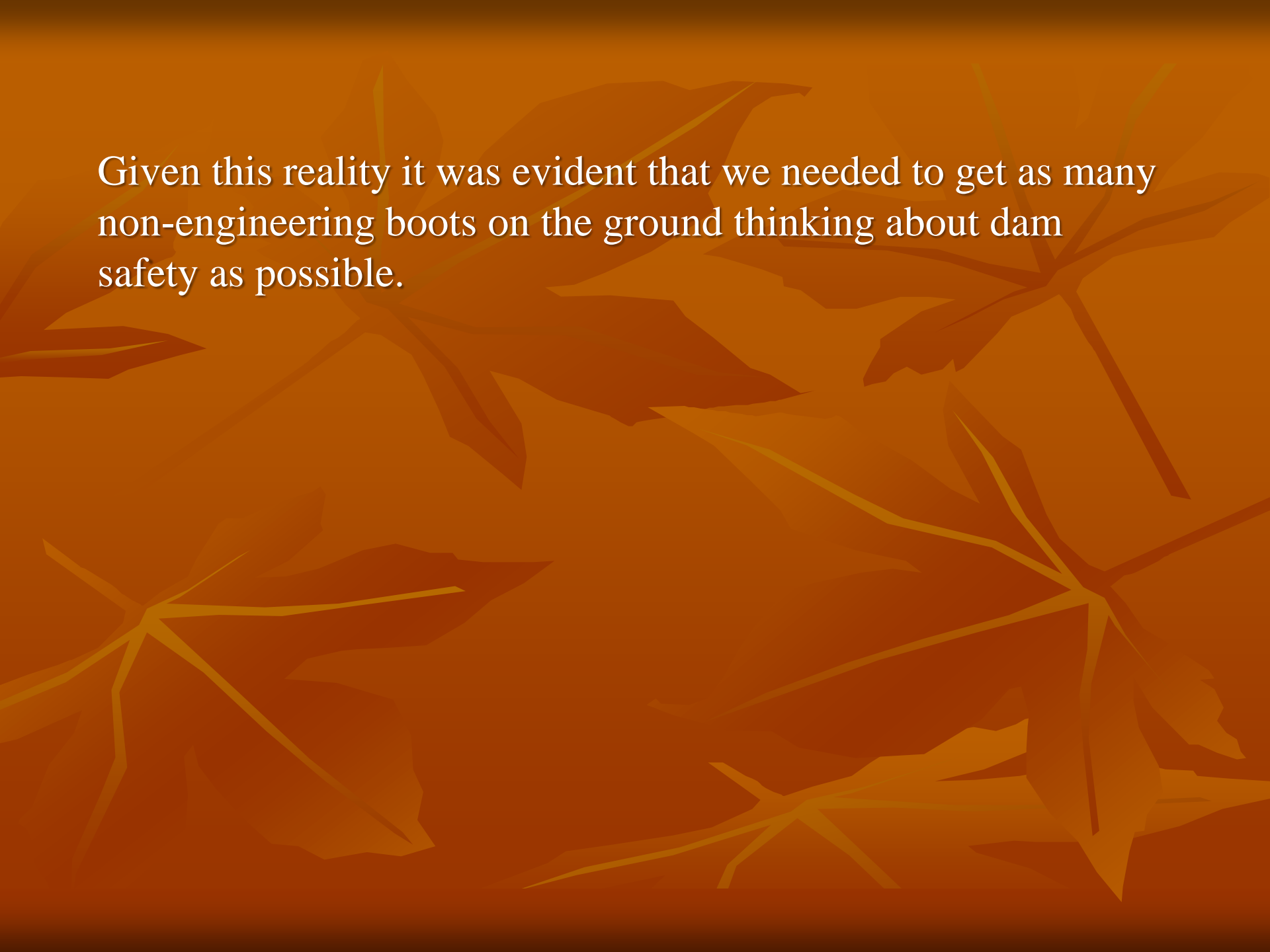
Problems on FS dams were accidentally discovered



Folks who visit FS dams most often

Most FS dams are remotely located with difficult access in many instances. Because of this and the small FS dam safety staff most folks visiting FS dams are non-engineers.

- 1) Non-engineering FS personnel – soil scientist, wilderness rangers, range conservationist, trail crews, firefighters....
- 2) Dam owners
- 3) Tourist and hunters



Given this reality it was evident that we needed to get as many non-engineering boots on the ground thinking about dam safety as possible.

What Products Were Developed?

- Online Training – Assessing Dams and Impoundments: A Beginner's Guide
- Pocket Safety Guide for Dams and Impoundments
- Dam Safety Poster

Why Where These Products Developed?

- Online Training Education
- Quick Reference Guide
- Informational Poster
- For Dam Safety of Earthen Dams and Impoundments
 - i.e., stock water ponds, irrigation ponds, low hazard dams
- Low hazard potential — no probable loss of human life and low economic and/or environmental losses

Who Were They Developed For?

- Developed for
 - Dam Owners
 - Engineering Technicians
 - Recreation Technicians
 - Range Conservationists
 - Other Forest Service Personnel
 - Any non-engineer

Online Training

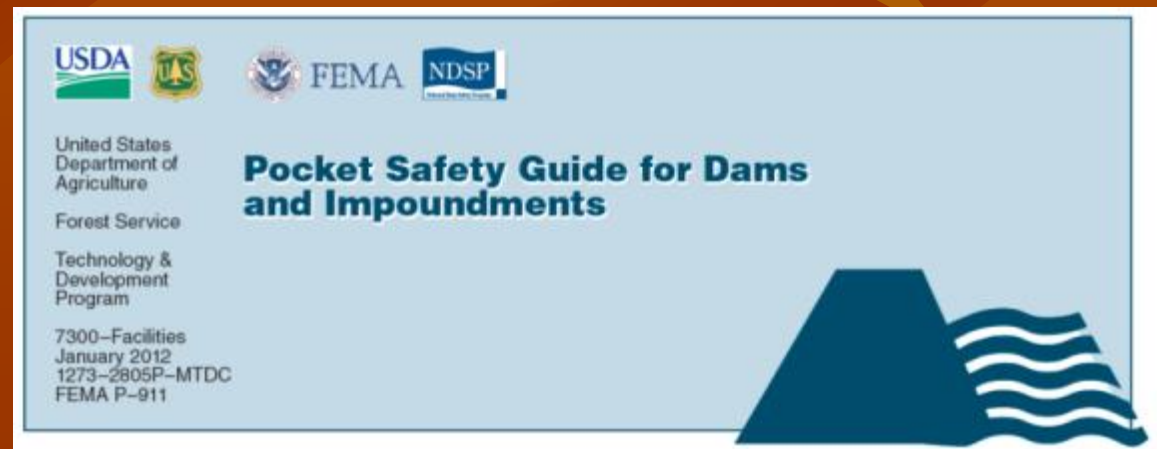
Assessing Dams and Impoundments: A Beginner's Guide

- Introduction
- Responsibility
- Dam Diagram
- Failures
- Assessment
- Problems
- Summary

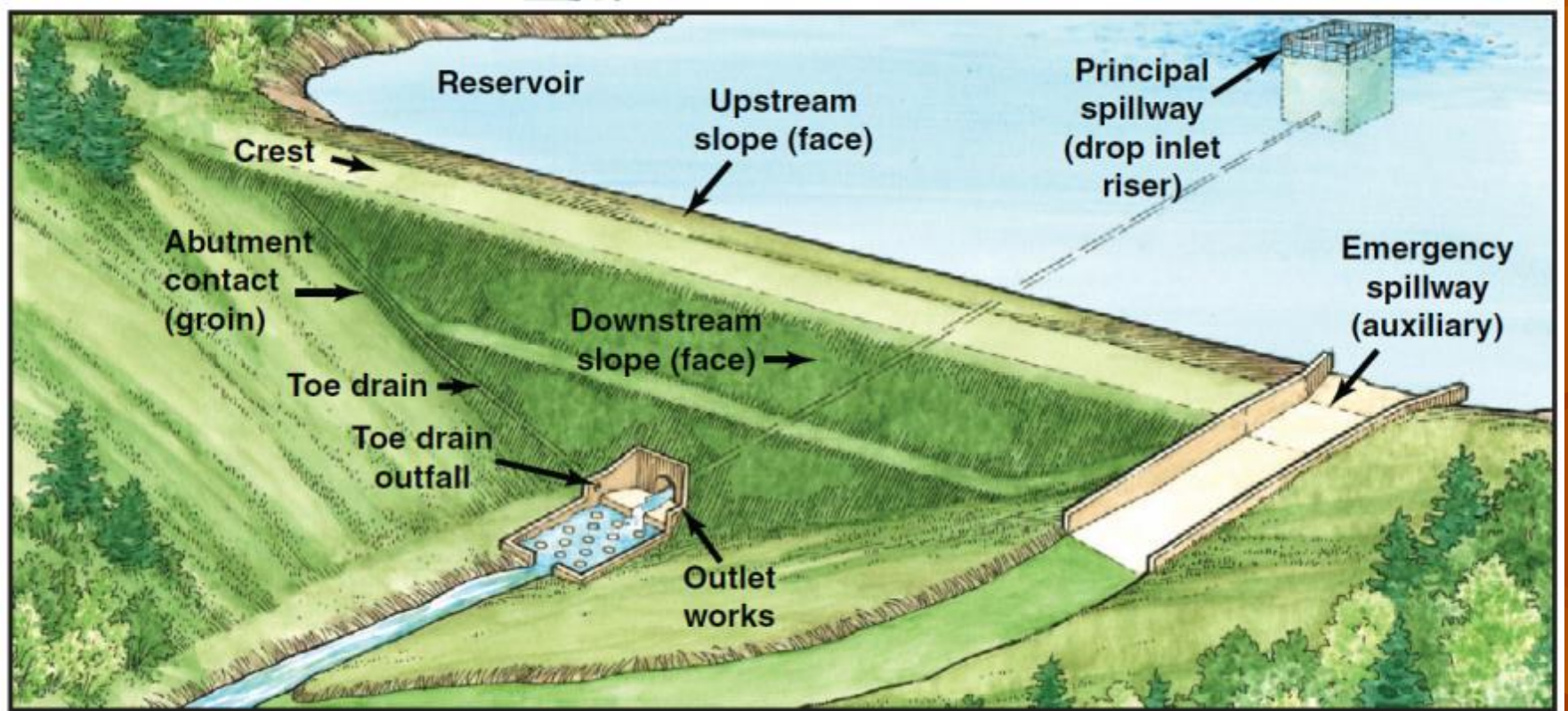


Pocket Safety Guide

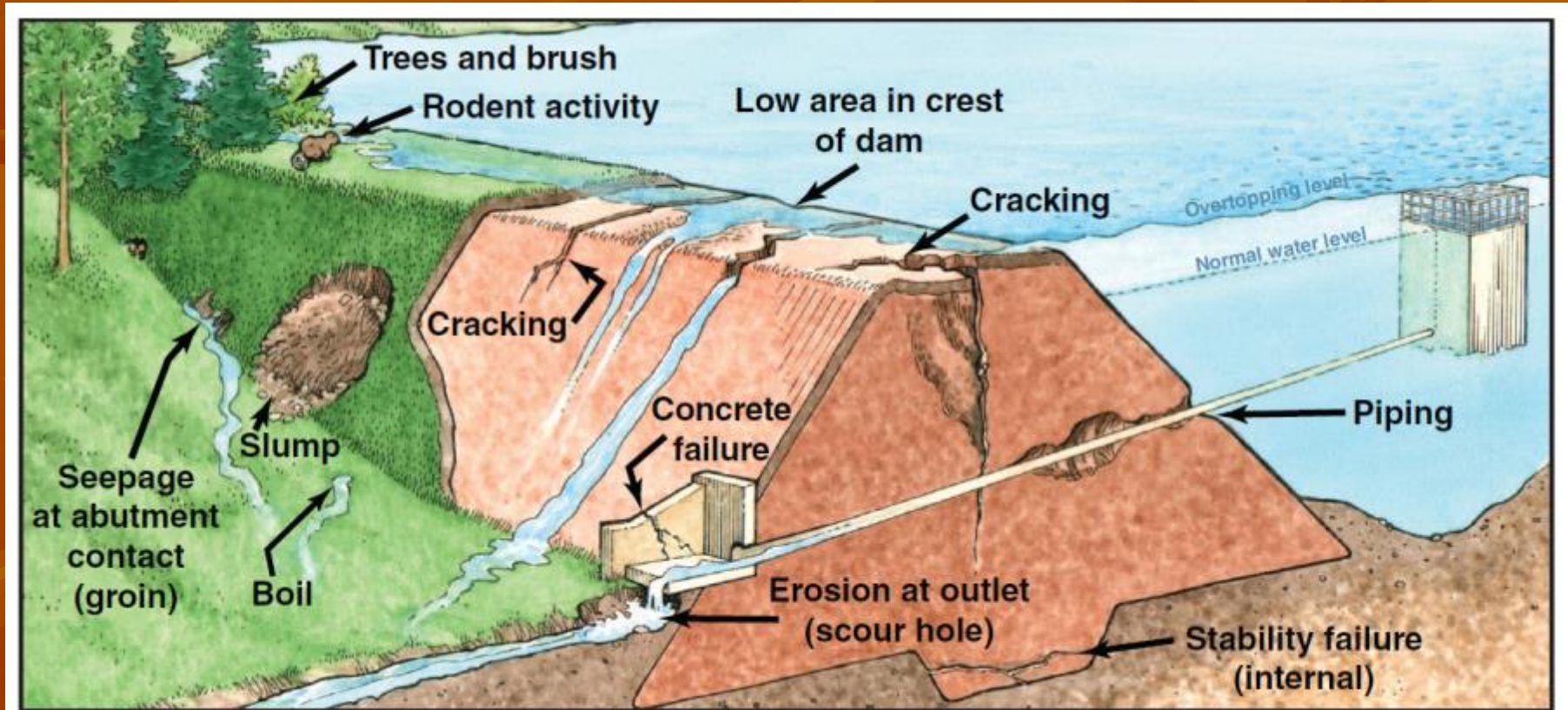
- Introduction
- Responsibility and Liability
- Dam Diagram
- Possible Dam Failures
- Resources
- Web Sites
- Useful Terms
- Questions



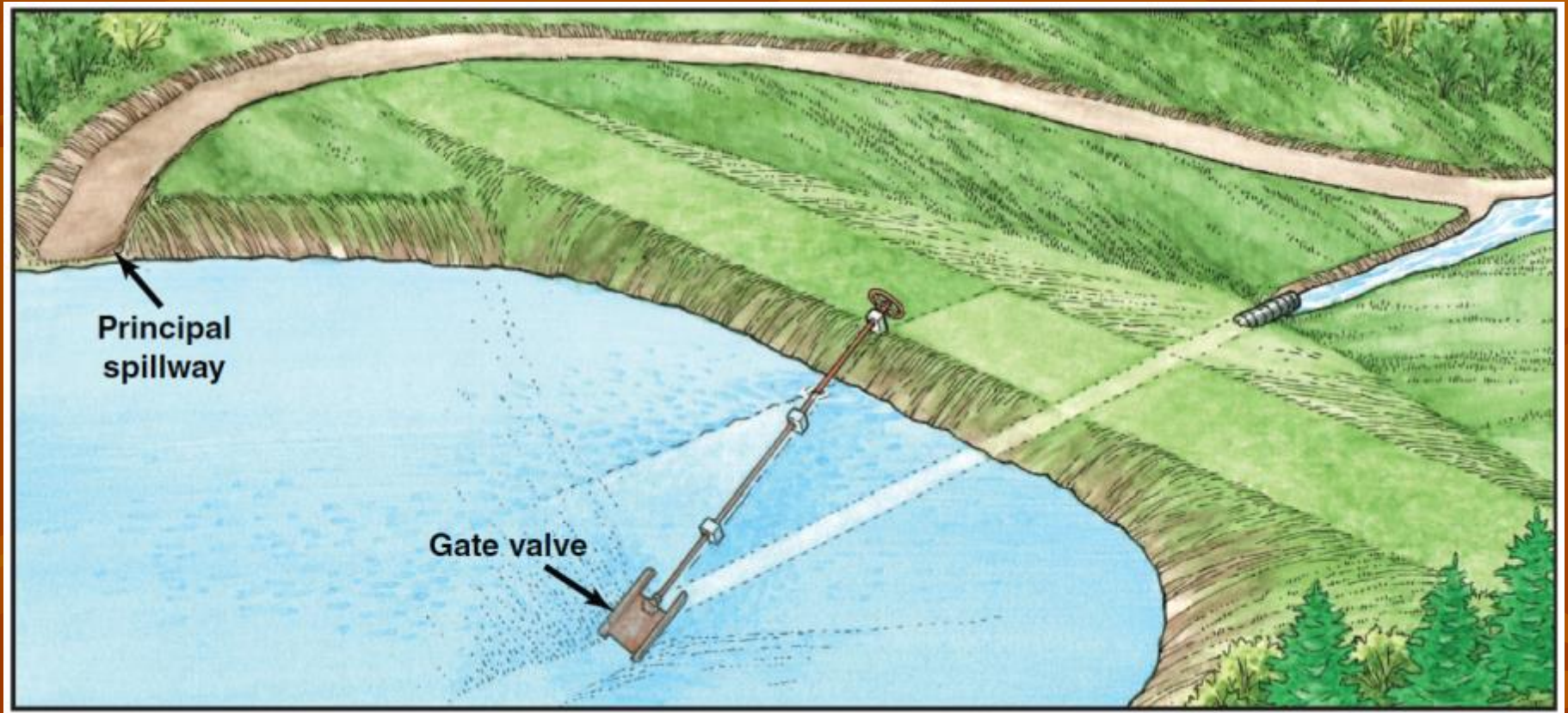
Dam Diagram



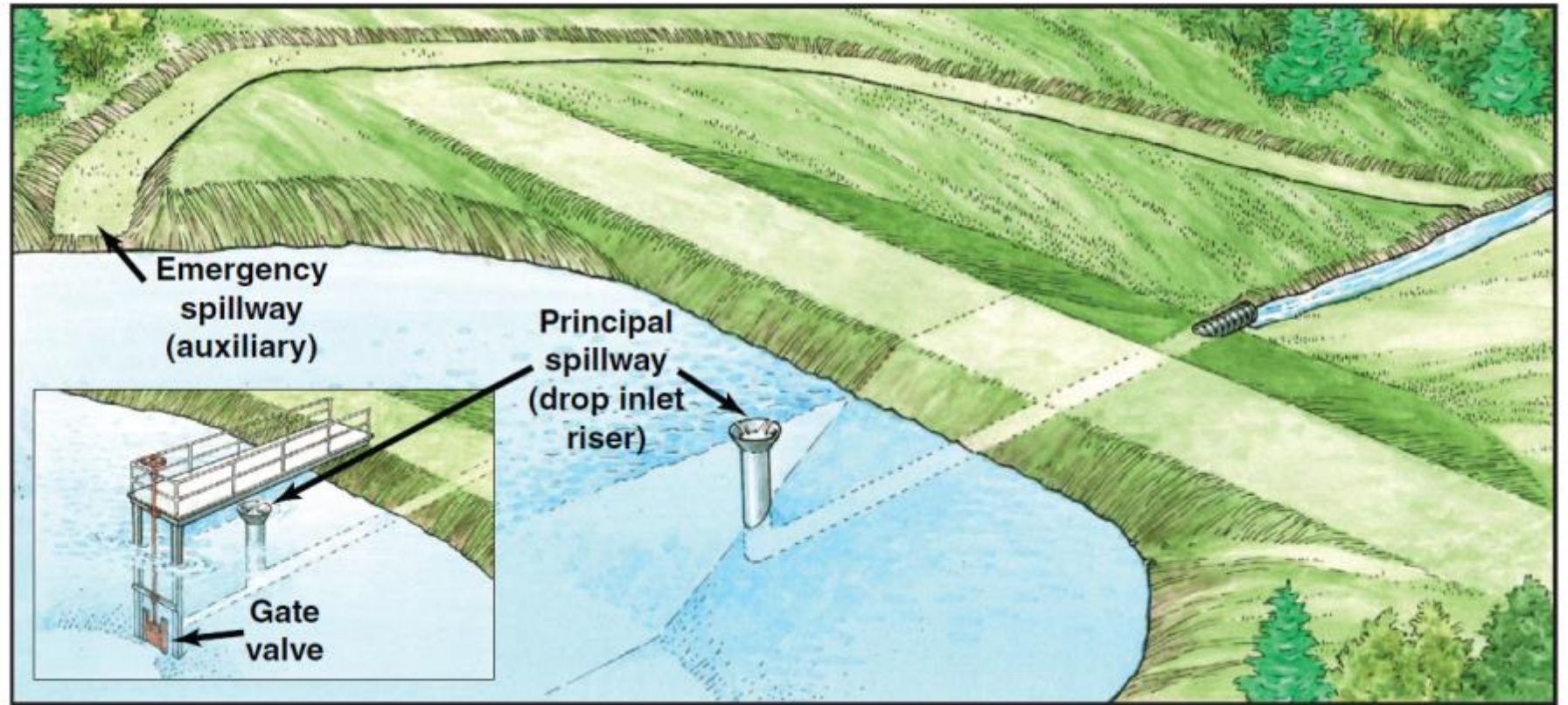
Structural deficiencies that could lead to failures



Outlet Structures (Typical Forest Service)



Outlet Structures (Typical Forest Service)



Dam Problems

- Some of the Most Common Problems:
 - Sinkholes
 - Slide, Slump, or Slip
 - Broken Down or Missing Riprap
 - Erosion
 - Trees or Obscuring Vegetation
 - Rodent Activity and Animal Impact
 - Livestock and Cattle Traffic
 - Transverse Cracking
 - Longitudinal Cracking
 - Low Area in the Crest of a Dam

Dam Problems

- Some of the Most Common Problems:
 - Excessive Quantity and/or Muddy Water Exiting From a Point
 - Seepage Water Exiting as a Boil in the Foundation
 - Seepage Water Exiting at the Abutment Contact
 - Seepage Water Exiting From a Point Adjacent to the Outlet Pipe
 - Failure of Concrete or Rock Outfall Structures
 - Outlet Releases Eroding the Toe of the Dam
 - Excessive Vegetation or Debris in the Spillway Channel or Around the Inlet
 - Erosion of Spillway Channels

Dam Problems

- **Narratives (top page)**
 - Probable Causes and Possible Consequences
 - Recommended Action
- **Illustration of Problems (bottom page)**
 - Schematic
 - Picture

Report the suspected problem to the appropriate Federal or State agency official immediately.

NO EQUATIONS

**simple description of problem
and recommended action**

Dam Problem Example



Slide, Slump, or Slip

Probable Causes and Possible Consequences

- Foundation movement or a too steep slope can cause earth or rocks to move along a slip plane which can lead to a slump of the embankment.
- Slide movements in the reservoir basin can lead to inlet obstruction or dam failure.

Recommended Action

Report the suspected problem to the appropriate Federal or State agency official immediately.

- Evaluate the extent of the slide.
- Monitor the slide.
- Draw down the reservoir level if the safety of the dam is threatened.
- Have a qualified engineer inspect the conditions and recommend further actions.

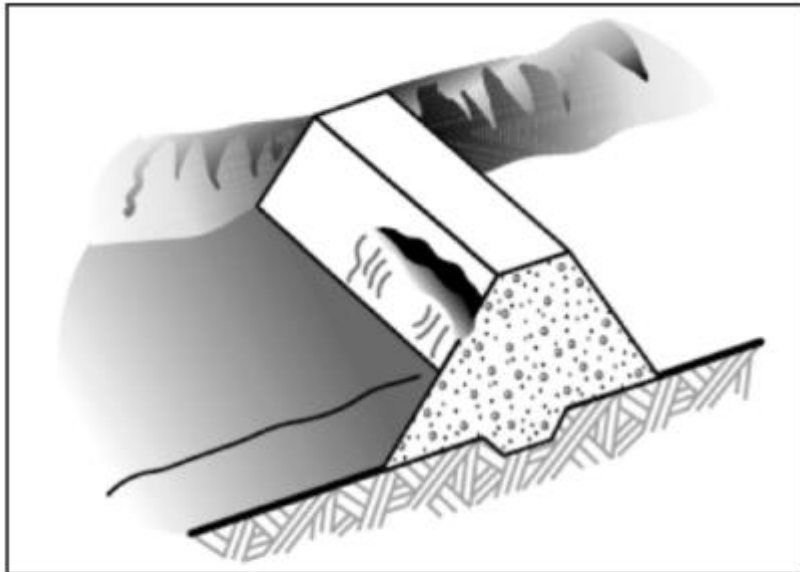


Figure 7—Slide, slump, or slip.



Figure 8—Slumping on the downstream face of a dam.



Dam Problem Example



Rodent Activity and Animal Impact

Probable Causes and Possible Consequences

- Cattail-filled areas and areas where trees are close to the reservoir provide ideal habitat and foraging areas for animals.
- An overabundance of rodents increases the chance of animal burrowing, which creates holes, tunnels, and caverns.
- Tunnels may reduce the required length of the seepage path, which could cause a piping problem.

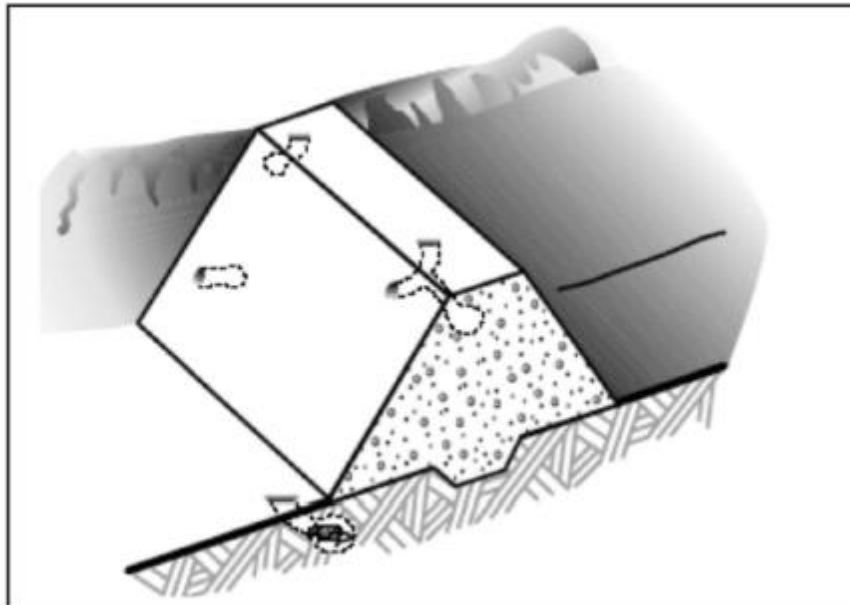


Figure 15—Rodent activity

Recommended Action

- Start a rodent control program to reduce the population and prevent future damage to the dam.
- Determine the exact location and extent of tunneling.
- Backfill existing rodent holes with suitable well-compacted material to repair damages.



Figure 16—Rodent holes in the dam face can cause dam failure.



Resources

- List of publications covers
 - Publications used to develop this Guide
 - Publications on operation and maintenance of dams
 - Publications on indepth dam safety evaluation
 - Training aids for dam safety

Web Sites

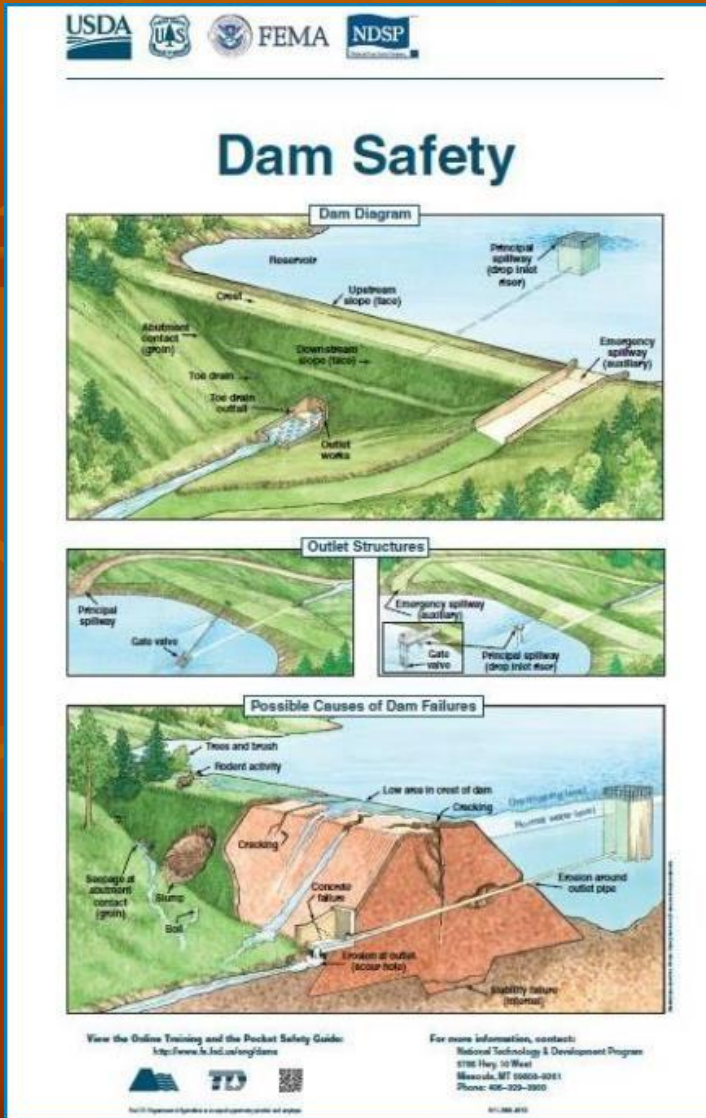
- Lists of good Web sites for dam resources
 - Association of State Dam Safety Officials (ASDSO)
 - Bureau of Reclamation
 - FEMA
 - Technical Service Center Resources for Dam Safety Programs

Useful Terms

- Glossary
- Commonly used dam terms
- Helps laymen describe problems to dam owners
- Helps dam owners describe problems to engineers

Allows everyone to speak to each other using the same terminology so that everyone can understand the problems of dams.

Dam Safety Poster



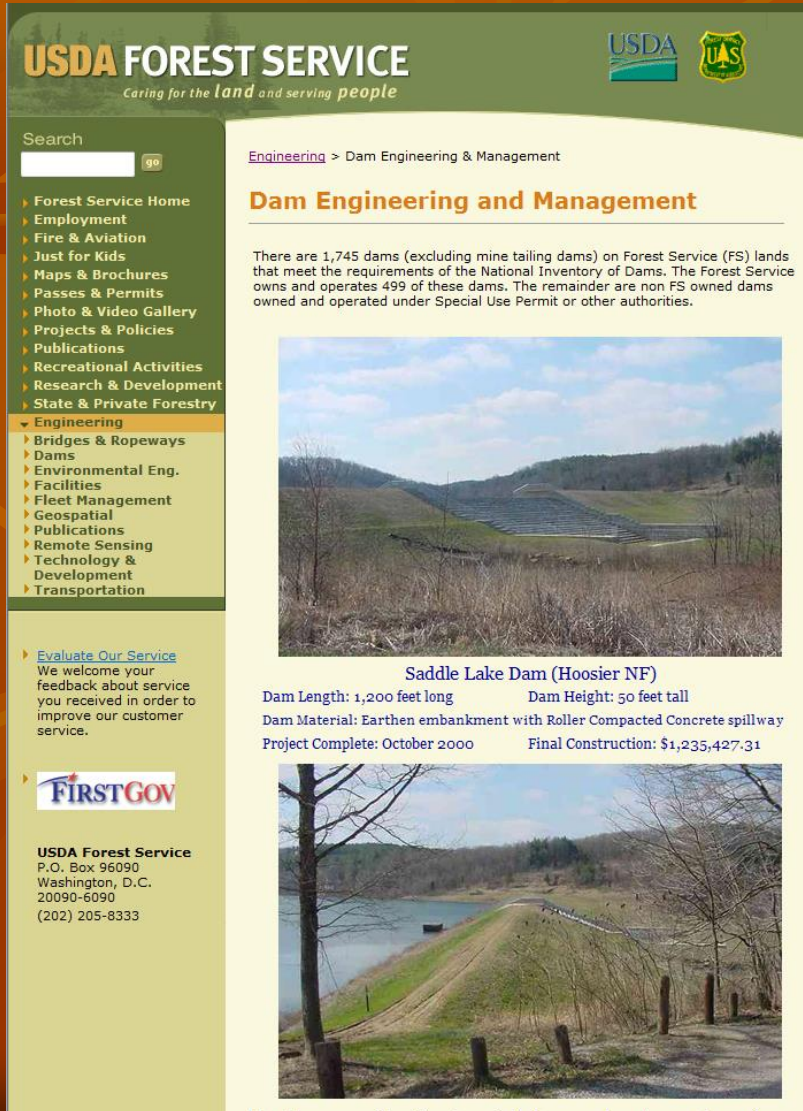
- Dam Diagram
- Outlet Structures
- Dam Diagram
- Possible Causes of Dam Failures
- Web Sites
- Contact Information for ordering products

Where Can you access this information?

■ Forest Service Web Site

■ www.fs.fed.us/eng/dams

At
Bottom
of
Web Page



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Caring for the land and serving people

USDA US

Search

- Forest Service Home
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 - Bridges & Ropeways
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 - Environmental Eng.
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We welcome your feedback about service you received in order to improve our customer service.


FIRSTGOV

USDA Forest Service
P.O. Box 96090
Washington, D.C.
20090-6090
(202) 205-8333

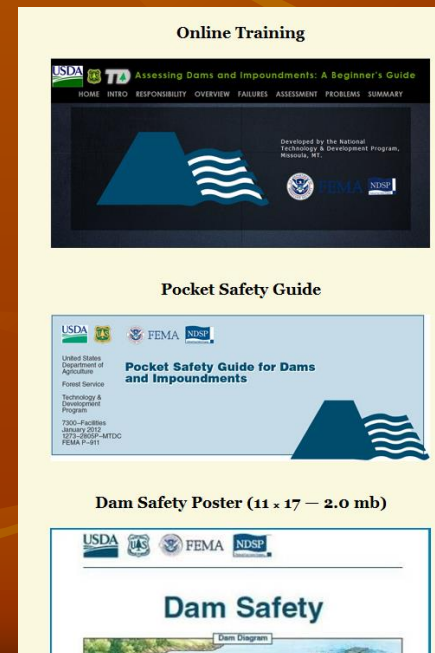

[Engineering](#) > Dam Engineering & Management

Dam Engineering and Management

There are 1,745 dams (excluding mine tailing dams) on Forest Service (FS) lands that meet the requirements of the National Inventory of Dams. The Forest Service owns and operates 499 of these dams. The remainder are non FS owned dams owned and operated under Special Use Permit or other authorities.



Saddle Lake Dam (Hoosier NF)
Dam Length: 1,200 feet long Dam Height: 50 feet tall
Dam Material: Earthen embankment with Roller Compacted Concrete spillway
Project Complete: October 2000 Final Construction: \$1,235,427.31



Online Training

Assessing Dams and Impoundments: A Beginner's Guide
HOME INTRO RESPONSIBILITY OVERVIEW FAILURES ASSESSMENT PROBLEMS SUMMARY

Developed by the National Technology & Development Program, Westport, VT

Pocket Safety Guide

United States Department of Agriculture
Forest Service
Technology & Development Program
7300-Facilities
January 2012
E273-2603F-MTDC
FEMA P-811

Pocket Safety Guide for Dams and Impoundments

Dam Safety Poster (11 x 17 - 2.0 mb)

Dam Safety
Dam Diagram

Ultimately this training and references are part of an overall dam safety strategy – Improved dam safety awareness and real time communication, monitoring, and response

- National Dam Safety API



Acknowledgments

- Association of State Dam Safety Officials
- Federal Emergency Management Agency
- Forest Service Regional Dam Engineers
- National Park Service
- U.S. Fish and Wildlife Service

Questions

The background of the slide features a pattern of stylized, overlapping leaves in various shades of orange, brown, and tan. The leaves are rendered in a flat, graphic style, creating a textured, autumnal effect. The word "Questions" is centered in a white, serif font with a subtle drop shadow, making it stand out against the busy background.